PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference | FOR FURTHER ACTION | see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. |
|---|---|---|
| 602052-PCT | | |
| International application No. | International filing date (*day/month/year*) | (Earliest) Priority Date (*day/month/year*) |
| PCT/KR99/00246 | 17 May 1999 (17.05.1999) | 16 May 1998 (16.05.1998) |
| Applicant | | |
| ENERTEC KOREA Co,. Ltd. et al. | | |

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
   ☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:
   ☐ contained in the international application in written form.
   ☐ filed together with the international application in computer readable form.
   ☐ furnished subsequently to this Authority in written form.
   ☐ furnished subsequently to this Authority in computer readable form.
   ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
2. ☐ **Certain claims were found unsearchable** (See Box I).
3. ☐ **Unity of invention is lacking** (See Box II).
4. With regard to the **title**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:
5. With regard to the **abstract**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. The figure of the **drawings** to be published with the abstract is Figure No.: 3
   ☒ as suggested by the applicant. ☐ None of the figures.
   ☐ because the applicant failed to suggest a figure.
   ☐ because this figure better characterizes the invention.

**PCT** WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H02K 21/18, 16/00, 29/00, 9/04 | A3

(11) International Publication Number: **WO 99/60692**

(43) International Publication Date: 25 November 1999 (25.11.99)

(21) International Application Number: PCT/KR99/00246

(22) International Filing Date: 17 May 1999 (17.05.99)

(30) Priority Data:
1998/17757 16 May 1998 (16.05.98) KR

(71) Applicant *(for all designated States except US)*: ENERTEC KOREA CO., LTD. [KR/KR]; 301 Dongyang Building, 80–14, Yangjae–dong, Seocho–gu, Seoul 137–130 (KR).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: BAE, Youn, Soo [KR/KR]; 170–57, Yuljun–dong, Jangan–gu, Suwon, Kyunggi–do 440–320 (KR).

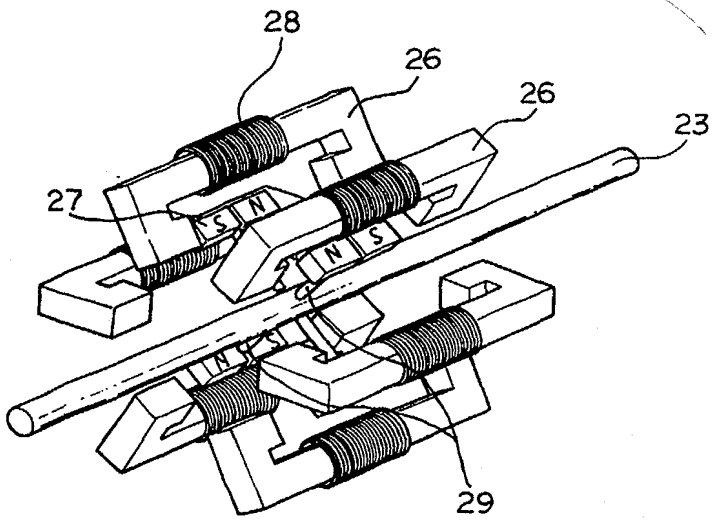
(74) Agent: YOON, Eui, Seoup; 302 Namdo Building, 823–24, Yoksam–dong, Kangnam–gu, Seoul 135–080 (KR).

(81) Designated States: AU, CA, CN, JP, RU, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

**Published**
*With international search report.*

(88) Date of publication of the international search report:
3 August 2000 (03.08.00)

(54) Title: MAGNETIC CIRCUIT FOR ROTATING APPARATUS




(57) Abstract

An energy conversion magnetic circuit is constituted with magnet pole pieces of magnets or armatures which are in parallel with respect to the shaft to obtain a dynamic force or an electromotive force. The magnetic circuit for a generator or an electric motor has a rotating shaft, a plurality of supporters fixedly mounted in a perpendicular direction to the circumference of the rotating shaft, a plurality of rotors arranged in parallel with respect to the shaft on each end of the plurality of supporters to be rotated by attraction force and repulsion force of a magnetic field, and a plurality of armatures having a coil wound on the body thereof. The coil is mounted at an interval outside the rotors and receives induced alternate magnetic flux of the rotors to generate a rectangular wave electromotive force or to obtain a high torque with input of electrical energy. The alternate magnetic flux generated when rotated, and magnet pole piece are arranged in parallel with the rotating shaft.

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| **DK** | Denmark | **LK** | Sri Lanka | **SE** | Sweden | | |
| **EE** | Estonia | **LR** | Liberia | **SG** | Singapore | | |

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 99/00246

A. CLASSIFICATION OF SUBJECT MATTER

IPC[7]: H 02 K 21/18, 16/00, 29/00, 9/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: H 02K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 87/02525 A1 (WEH) 23 April 1987 (23.04.87), page 6, line 25 - page 7, line 20; page 8, lines 18-25; page 11, lines 1-11; page 13, line 1 - page 14, line 20; fig. 2-4. | 1-3,5 |
| X<br>Y | US 4720640 A (ANDERSON) 19 January 1988 (19.01.88), column 17, lines 1-39; fig. 18, 23; claims 1, 14, 26, 36,38, 54. | 1-5<br>6 |
| Y | US 3330975 A (OSTERWALDER) 11 July 1967 (11.07.67), column 3, lines 20-35; column 6, line 51 - column 9, line 39; fig. 2, 3, 15, 16, 17 and 21. | 6 |

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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
„A" document defining the general state of the art which is not considered to be of particular relevance
„E" earlier application or patent but published on or after the international filing date
„L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 12 May 2000 (12.05.00) | 25 May 2000 (25.05.00) |
| Name and mailing adress of the ISA/AT<br>Austrian Patent Office<br>Kohlmarkt 8-10; A-1014 Vienna<br>Facsimile No. 1/53424/200 | Authorized officer<br>Hawel<br>Telephone No. 1/53424/458 |

Form PCT/ISA/210 (second sheet) (July 1998)

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR 99/00246

| Patent document cited in search report | | | Publication date | Patent family member(s) | | | Publication date |
|---|---|---|---|---|---|---|---|
| WO | A1 | 8702525 | 23-04-1987 | DE | A1 | 3536538 | 23-04-1987 |
| | | | | DE | C0 | 3676193 | 24-01-1991 |
| | | | | EP | A1 | 243425 | 04-11-1987 |
| | | | | EP | B1 | 243425 | 12-12-1990 |
| | | | | DE | A1 | 3602687 | 06-08-1987 |
| US | A | 4720640 | 19-01-1988 | | | none | |
| US | A | 3330975 | | | | none | |

PCT/KR99/00246

# PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

## PCT

### NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

| | |
|---|---|
| **Date of mailing** (day/month/year)<br>18 January 2000 (18.01.00) | |
| **International application No.**<br>PCT/KR99/00246 | **Applicant's or agent's file reference**<br>602052-PCT |
| **International filing date** (day/month/year)<br>17 May 1999 (17.05.99) | **Priority date** (day/month/year)<br>16 May 1998 (16.05.98) |
| **Applicant**<br>BAE, Youn, Soo | |

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

14 December 1999 (14.12.99)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|---|
| **The International Bureau of WIPO**<br>**34, chemin des Colombettes**<br>**1211 Geneva 20, Switzerland** | Authorized officer<br>Juan Cruz |
| Facsimile No.: (41-22) 740.14.35 | Telephone No.: (41-22) 338.83.38 |

Form PCT/IB/331 (July 1992) 3057077

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 99/00246

A. CLASSIFICATION OF SUBJECT MATTER

IPC[7]: H 02 K 21/18, 16/00, 29/00, 9/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: H 02K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 87/02525 A1 (WEH) 23 April 1987 (23.04.87), page 6, line 25 - page 7, line 20; page 8, lines 18-25; page 11, lines 1-11; page 13, line 1 - page 14, line 20; fig. 2-4. | 1-3,5 |
| X<br>Y | US 4720640 A (ANDERSON) 19 January 1988 (19.01.88), column 17, lines 1-39; fig. 18, 23; claims 1, 14, 26, 36,38, 54. | 1-5<br>6 |
| Y | US 3330975 A (OSTERWALDER) 11 July 1967 (11.07.67), column 3, lines 20-35; column 6, line 51 - column 9, line 39; fig. 2, 3, 15, 16, 17 and 21. | 6 |

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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
„A" document defining the general state of the art which is not considered to be of particular relevance
„E" earlier application or patent but published on or after the international filing date
„L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 12 May 2000 (12.05.00) | 25 May 2000 (25.05.00) |
| Name and mailing adress of the ISA/AT<br>Austrian Patent Office<br>Kohlmarkt 8-10; A-1014 Vienna<br>Facsimile No. 1/53424/200 | Authorized officer<br>Hawel<br>Telephone No. 1/53424/458 |

Form PCT/ISA/210 (second sheet) (July 1998)

# INTERNATIONAL SEARCH REPORT

Information on patent family members

[redacted]ational application No.
PCT/KR 99/00246

| Patent document cited in search report | | | Publication date | Patent family member(s) | | | Publication date |
|---|---|---|---|---|---|---|---|
| WO | A1 | 8702525 | 23-04-1987 | DE | A1 | 3536538 | 23-04-1987 |
| | | | | DE | C0 | 3676193 | 24-01-1991 |
| | | | | EP | A1 | 243425 | 04-11-1987 |
| | | | | EP | B1 | 243425 | 12-12-1990 |
| | | | | DE | A1 | 3602687 | 06-08-1987 |
| US | A | 4720640 | 19-01-1988 | | | none | |
| US | A | 3330975 | | | | none | |

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# PATENT COOPERATION TREATY

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REC'D 24 NOV 2000
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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

6

| Applicant's or agent's file reference | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
|---|---|---|
| 602052–PCT | | |
| International application No. | International filing date (*day/month/year*) | Priority Date (*day/month/year*) |
| PCT/KR99/00246 | 17 May 1999 (17.05.99) | 16 May 1998 (16.05.98) |
| International Patent Classification (IPC) or national classification and IPC | | |
| IPC[7]: H02K 21/18, 16/00, 29/00, 9/04 | | |
| Applicant | | |
| ENERTEC KOREA CO., LTD. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examination Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 14 December 1999 (14.12.99) | 08 September 2000 (08.09.00) |
| Name and mailing address of the IPEA/AT<br>Austrian Patent Office<br>Kohlmarkt 8-10<br>A-1014 Vienna<br>Facsimile No. 1/53424/200 | Authorized officer<br>Hawel<br>Telephone No. 1/53424/315 |

Form PCT/IPEA/409 (cover sheet) (July 1998)

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/KR 99/00246

## I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____.

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under Article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____.

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____.

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____.

☐ the claims, Nos. _____.

☐ the drawings, sheets/fig _____.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as „originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**

International application No.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Claims | 6 | YES |
| | Claims | 1-5 | NO |
| Inventive step (IS) | Claims | | YES |
| | Claims | 1-6 | NO |
| Industrial applicability (IA) | Claims | 1-6 | YES |
| | Claims | | NO |

2. Citations and explanations (Rule 70.7)

Please, see at the written opinion (Date of mailing 25 May 2000) !

Since no restriction of the protection demand was carried out all statements of the written opinion remain unchanged.
Therefore, as explained in the written opinion (in Box V) the document WO 87/02525 A1, showing a current converter feeding a synchronous machine with coils mounted at intervals outside the plurality of the rotors and forming magnetic field in the parallel direction with the rotating shaft, anticipates the claims 1 – 3 and 5 of this application.
As explained in the written opinion (in Box V) the document US 4,720,640 A, showing a fluid powered electrical generator with a parallel structure of magnet pole pieces with respect to the shaft with a plurality of permanent magnet pole pieces of the rotor perpendicular mounted to the shaft, anticipates the claims 1 – 5 of this application.
As explained in the written opinion the document US 3,330,975 A, showing a self–starting synchronous motor with spiral magnetic flux deriving and a detection system obtaining the current, anticipates in combination with US 4,720,640 A the features of claim 6 of this application.
Consequently, claims 1 – 5 of the application are not new and include no inventive step and claim 6 of this application is only new.

But, the industrial application of all claims 1 – 6 of the application is given.

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

As mentioned in the written opinion (Box VII) the term "york" used for member 7 could not be found in any dictionary, and so for this examination report the term "joke" was used for member 7.

**PCT** WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H02K — A2

(11) International Publication Number: **WO 99/60692**

(43) International Publication Date: 25 November 1999 (25.11.99)

(21) International Application Number: PCT/KR99/00246

(22) International Filing Date: 17 May 1999 (17.05.99)

(30) Priority Data:
1998/17757 16 May 1998 (16.05.98) KR

(71) Applicant *(for all designated States except US)*: ENERTEC KOREA CO., LTD. [KR/KR]; 301 Dongyang Building, 80–14, Yangjae–dong, Seocho–gu, Seoul 137–130 (KR).

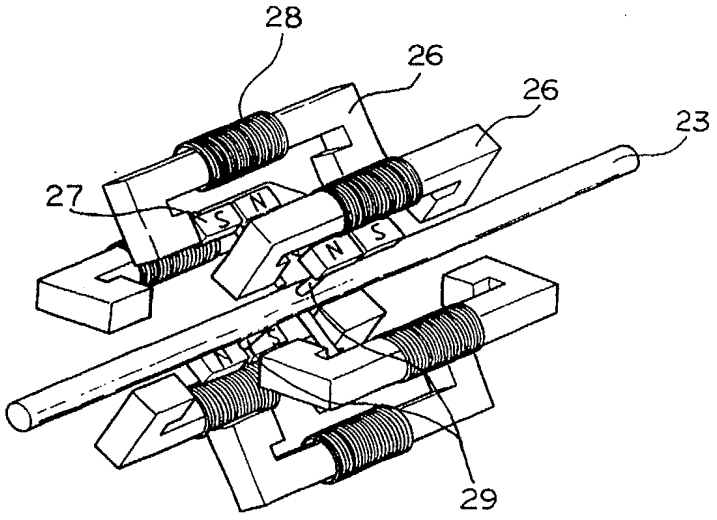
(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: BAE, Youn, Soo [KR/KR]; 170–57, Yuljun–dong, Jangan–gu, Suwon, Kyunggi–do 440–320 (KR).

(74) Agent: YOON, Eui, Seoup; 302 Namdo Building, 823–24, Yoksam–dong, Kangnam–gu, Seoul 135–080 (KR).

(81) Designated States: AU, CA, CN, JP, RU, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

**Published**
*Without international search report and to be republished upon receipt of that report.*

(54) Title: MAGNETIC CIRCUIT FOR ROTATING APPARATUS




(57) Abstract

An energy conversion magnetic circuit is constituted with magnet pole pieces of magnets or armatures which are in parallel with respect to the shaft to obtain a dynamic force or an electromotive force. The magnetic circuit for a generator or an electric motor has a rotating shaft, a plurality of supporters fixedly mounted in a perpendicular direction to the circumference of the rotating shaft, a plurality of rotors arranged in parallel with respect to the shaft on each end of the plurality of supporters to be rotated by attraction force and repulsion force of a magnetic field, and a plurality of armatures having a coil wound on the body thereof. The coil is mounted at an interval outside the rotors and receives induced alternate magnetic flux of the rotors to generate a rectangular wave electromotive force or to obtain a high torque with input of electrical energy. The alternate magnetic flux generated when rotated, and magnet pole piece are arranged in parallel with the rotating shaft.

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| **BB** | Barbados | **GH** | Ghana | **MG** | Madagascar | **TJ** | Tajikistan |
| **BE** | Belgium | **GN** | Guinea | **MK** | The former Yugoslav Republic of Macedonia | **TM** | Turkmenistan |
| **BF** | Burkina Faso | **GR** | Greece | | | **TR** | Turkey |
| **BG** | Bulgaria | **HU** | Hungary | **ML** | Mali | **TT** | Trinidad and Tobago |
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| **DK** | Denmark | **LK** | Sri Lanka | **SE** | Sweden | | |
| **EE** | Estonia | **LR** | Liberia | **SG** | Singapore | | |

# MAGNETIC CIRCUIT FOR ROTATING APPARATUS

## BACKGROUND

### 1. Field of the invention

The present invention relates to a magnetic circuit for energy conversion having a structure that magnets and magnet pole pieces(or planes) of an armature are disposed in parallel with respect to the shaft of an electric motor in order for a flux of a magnetic field to form a magnetic circuit in parallel with the shaft, to thereby obtain a dynamic force or a rectangular wave electromotive force.

### 2. Description of the Prior Art

A rotating apparatus and a power system, which are used so far, is structured vertically(at the right angle) when magnet 5 and magnet pole pieces(or planes) of an armature are traversely disposed (hereinafter, referred to as -with respect to a shaft-), so that a vertical type magnetic circuit is constructed which a flux of a magnetic field is circulated in directions of york 7, armature 6, magnet 5, armature 6, and magnet 5.

FIG. 1A is a schematic view of a conventional vertical type electric motor which has a magnetic flux in a vertical direction with respect to the motor shaft, FIG. 1B is a view for showing a flow of a magnetic field in the electric motor of FIG. 1A

As shown in FIG. 1A, the conventional electric motor includes an annular stator 1 and a rotor 2 rotating in the annular stator 1. The annular stator 1 is

constituted with an armature 6 and a york 7, and the rotor 2 has a shaft 3 and magnet 5.

FIG.1B shows a different structure from FIG. 1A. That is, magnet 15 is formed on outside and an armature 16 is formed on inside to be rotated together with an armature 16.

Since magnetic circuits in FIGs. 1A and 1B, as shown in FIG. 1B, forms a flow of a magnetic flux vertically(at the right angle) with respect to the shaft when rotating, the magnetic circuits produces a rectangular wave in electromotive force signal system or generates a torque by means of a rectangular wave control input.

Further, as shown in FIG. 1A, in order for the magnet pole pieces of magnet 5 be formed in the vertical direction with respect to the shaft to be rotated, mechanical vibration of applied attraction and repulsion forces by means of the flow of a magnetic field is applied in the cross-sectional direction, to thereby apply much stress on the shaft.

Particulary, this phenomenon at a high speed increases load to the shaft. In order to solve the problem, strenuous exertion has been invested for the development of high strength material of excellent tensile toughness and for high precision machining technology so as to inevitably increase the production cost.

Further, the magnetic circuit in the conventional vertical circuit type electrical motor has another cost increase factor with respect to the maintenance fee and production cost because of a magnetic loss by a magnetic resistance according to multilevel flows of a magnetic field, an energy loss by iron core loss, etc., according to unnecessary material, and material loss by unnecessary magnetic circuit structures.

FIG. 2A is a view for showing a conventional three-phase full-wave rectifier circuit, FIG. 2B is a view for showing a voltage wave by a conventional three-phase generator, and FIG. 3C is a view for showing a rectified wave of a voltage wave generated by a conventional three-phase generator through the rectifier circuit of FIG. 2A.

As shown in FIG. 2A to FIG. 2C, rectification from an alternate current(AC) wave to a direct current(DC) wave(actually, a pulsating wave) requires a complex circuit including an Y-connection and diodes D1, D2, D3, D4, D5, and D6. Further, high precision filters are required in order to obtain an nearly complete direct current wave.

However, in actual, since it is difficult to obtain a complete DC current in a high voltage, the cost is increased in a system requiring a nearly complete high DC voltage with energy loss by various constituents used for obtaining a high and pure DC voltage.

## SUMMARY OF THE INVENTION

In order to solve the above problems, it is a first object to provide a magnetic circuit for a rotating apparatus having magnet pole pieces(planes) of a magnetic rotor or a static armature (structures such as magnetic stator and rotating armature are included) disposed in parallel with a shaft(when the shaft is traversely disposed) as a magnetic circuit for a magnetic flux of magnet side to be circulated in the traverse(parallel) direction, to thereby obtain a high torque rotation force by a highly efficient rectangular electromotive force according to a mechanical rotation force and by a rectangular wave control electric power according to an electric

energy.

It is a second object to provide a magnetic circuit for a rotating apparatus having a propeller mounted on a supporter connecting a shaft and a rotor with pole pieces disposed in parallel with respect to the shaft, to thereby obtain a propulsion force by using an air convection phenomenon appearing upon the rotation of the propeller or a rectangular wave electromotive force by -wind force- which is a mechanical propulsion force.

It is a third object to provide a magnetic circuit for a rotating apparatus having a wave washer between the shaft and bearings so that mechanical vibrations appearing in parallel with the shaft are absorbed and the mechanical vibrantions apprearing by the operation of attraction and repulsion forces applied perpendicularly to the shaft are minimal compared to other device, thereby obtaining a high speed rotation force.

It is a fourth object to provide a magnetic circuit for a rotating apparatus having a matrix-structured magnetic circuit providing a twist angle to magnets and rotors so that a spiral flow of a magnetic field flux is derived to reduce a reaction force of an armature occurring upon generation of an electromotive force and a high speed rotating force is obtained upon generation of a mechanical dynamic force.

It is a fifth object to provide a magnetic circuit for a rotating apparatus having a compound structure of multilayers of magnets and armatures on the same shaft wherein one layer is used as an exciter and another layer is used as a rotor or a synchronous machine.

It is a sixth object to provide a magnetic circuit for a rotating apparatus with a

flow of a magnetic field circulated traversely (in parallel) in directions of magnet, armature and magnet with respect to the shaft, thus capable of reducing material loss by eliminating a york which connects armatures or magnets.

It is a seventh object to provide a magnetic circuit for a rotating apparatus having a magnetic resistance of a slit between armatures(phases) and magnets in order for a flux of a magnetic field not to be circulated between the armatures and magnets, so that a magnetic field flux in magnets is guided to be magnetically circulated along an armature to a neighboring magnets, to thereby obtain a rectangular wave of an electromotive force occurring according to interlinkage of magnetic field flux circulated in coils of an armature.

## BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects of the present invention will become readily apparent by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein:

FIG. 1A is a schematic view of a conventional vertical type electric motor and synchronous machine which has a magnetic flux in a vertical direction with respect to the motor shaft;

FIG. 1B is a view for showing a flow of a magnetic field in the electric motor of FIG. 1A;

FIG. 2A is a view for showing a conventional 3-phase full wave rectifying circuit;

FIG. 2B is a view for showing a voltage waveform by a conventional 3-phase generator;

FIG. 2C shows a full-wave rectified waveform of a voltage waveform of a conventional 3-phase generator;

FIG. 3 is a schematic perspective view of a 4-pole 3-phase generator according to one embodiment of the present invention;

FIG. 4A shows a waveform of a magnetic field of 4-pole 3-phase generator according to one embodiment of the present invention;

FIGs. 4B, 4C, 4D, and 4E show electromotive force waveforms of a 3-phase generator according to one embodiment of the present invention;

FIGs. 5A and 5B are load state views of a generator according to one embodiment of the present invention;

FIG. 6 is a view for showing a magnetic flow of a single phase motor according to another embodiment of the present invention; and

FIG. 7 is an explanatory view of operations of a single phase motor according to another embodiment of the present invention.

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

According to one embodiment of the present invention, a magnetic circuit for a rotating apparatus which is employed for a rectangular wave generator or a rectangular wave electric motor includes a rotating shaft, a plurality of supporters fixedly mounted perpendicularly to the rotating shaft, a plurality of rotors each mounted to each end of the plurality of supporters in order for pole pieces(faces) to be parallel with the rotating shaft so that the rotors are rotated by an attraction force and a repulsion force of a magnetic field, and a plurality of stators (armatures) mounted in a certain interval to each other and each having a coil on

their body to obtain alternate magnetic field flux from the pole pieces( faces) of the rotors (magnets) occurring upon rotation of the rotors.

Further, according to a preferred characteristic of the present invention, a rectangular wave electric power generator, a annular magnetic field flux deriver, and a mechanical dynamic power generator, a phase angle detector, and a position detector are included. The rectangular wave electric power generator has C-type, U-type, and I-type or twist-structured C-type, U-type, and I-type armatures for derivation of an alternate magnetic field flux (or magnetic flux) of a magnet generated upon rotation. A york that is a magnetically circulating medium between armatures and magnets is eliminated to generate a rectangular wave electromotive force and a rectangular wave signal according to discontinuous flow of magnetic field flux by a magnetic resistance.

According to a preferred characteristic of the present invention, the annular magnetic field flux deriver has an armature and magnet. The bodies of the armature and magnet have skew-structured twist angles so that a flow of a magnetic flux upon rotation is formed annually.

The mechanical dynamic power generator has a plurality of armatures and a plurality of magnets so that rotors are rotated by a rectangular wave alternate magnetic flux generated by electric energy. The rotors are disposed in raw with respect to the shaft so that parallel driving is enabled according to a required torque quantity.

The phase angle detector and the position detector obtain phase angles and position information according to a quantity change of a rectangular wave electromotive force by means of a different winding number of coil mounted on an

armature at a necessary position.

As another preferred characteristic of the present invention, a magnetic circuit of complex functions for a rotating apparatus. The magnetic circuit has the multilayer of magnets and armatures on one shaft, some layers are used for rotors, some are used for synchronous machines or rectangular wave generators, and the other are used for exciters which excites magnet.

According to another preferred characteristic of the present invention, a magnetic circuit for a rotating apparatus having a DC electric power generator is further provided. In the DC electric power generator, rectangular wave electric powers from a plurality of armatures are connected in a single phase-type manner to produce a DC electric power.

As shown in FIG. 3, rotors 27 are fixed to supporters 29, and pole pieces of the rotors 27 are mounted in parallel with respect to the shaft 23. Further, coils 28 is mounted on the stators 26 to be opposite to pole pieces(faces) with respect to the shaft 23.

In the embodiment of the present invention, a 4-pole 3-phase rotor is, for possible convenience, shown for description of a rotating operation.

Accordingly, stators 26 are disposed in interval of 60 degree, so there are six stators 26. Even though there is not shown here, these stators 26 are fixed by the housing. Rotors 27 are disposed in interval of 90 degree and mounted on one ends of supporters 29 fixed to the shaft 23. The polarity of one rotor has an opposite polarity or the same polarity (not shown) to the neighboring rotor as shown in FIG. 3.

The number and polarity of the stators 26 and rotors 27 may be changed.

Further, a propeller(not shown) may be mounted on a supporter which connects the shaft 23 and the rotor 27 or between the shaft 23 and the rotor 27, so that propulsion force is obtained from air convection phenomenon generated by the rotation of the rotors 27.

In the rectangular wave generator(not shown) according to the embodiment of the present invention, as the shaft 23 is rotated by an external dynamic power, a magnetic rotor generates triangle wave magnetic flux. The triangle wave magnetic flux is induced to an armature to generate a rectangular waves as shown in FIGs. 4B, 4C, and 4D to winding coils. The triangle waves are generated by a matrix-structured magnetic circuit and current controls of the field in the apparatus according to the embodiment of the present invention.

FIG. 4E is a view for showing a conversion to a DC electric power by composite waves of FIGs. 4B, 4C, and -4D.

Further, sinusoidal waves are made by a phase interval and field structure.

FIGs. 5A and 5B are views for showing a load state of a generator according to an embodiment of the present invention.

As shown in FIG. 5A, when described with 4-pole 3-phase, as given from a magnet (A) to a magnet (D), armatures 52-1 and 52-2 of one body in a twisted structure does not show any polarity as any load is not applied, but show an induced opposite polarity to a magnetic flux as load is applied, according to the Lenz law.

However, according to the embodiment of the present invention, as the above magnet state, that is, as given from the magnet (A) to the magnet (D), is rotated in an arrow direction denoted above the magnet (A) by an external dynamic

force and the magnet (A) escapes from magnet pole pieces(face) 52-1 and 52-3, a magnet polarity S1 is induced in the magnet pole piece(face) 52-1 of the armature and a magnet polarity N1 is induced in the magnet pole piece(face) 52-2 of the armature of a twist structure. Therefore, the rotation of the magnet (A) is interrupted and the rotation of the magnet (B) is promoted in the rotation direction.

By such operation, the action and reaction of an armature occur together, which is a characteristic factor of the present invention that can not be obtained in the conventional generator.

At this time, the magnets are arranged at the right angle or at a different angle if necessary.

In FIG. 5B, the magnets are arranged in the same polarity and armatures are arranged side by side with respect to the magnets. As rotated in the arrow direction denoted over the magnet (A) by load of an external dynamic force, a magnetic polarity S1 is induced on the magnet pole piece(face) of an armature 53-1 when the magnet (A) gets out of magnet pole pieces (faces) of armatures 53-1 and 53-3, and the magnet pole piece (faces) of armature 53-3 of the body by the same arrangement structure is induced to a magnetic polarity N1, so that the magnet (A) is drawn back for the rotation to be interrupted and the magnet (B) is also interrupted in its progress by the magnet pole pieces(faces) of other armatures 53-2 and 53-4. However, the purpose of the magnetic circuit of FIG. 5B is for obtaining an on-off signal so that much energy is not consumed.

FIG. 6 is a view for explaining a flow of a magnetic field when operated as an electric motor by applying current to a coil of a stator in a single phase motor having six rotors in interval of 60 degree in a digital generator of FIG. 3, and FIG. 7

is a view for explaining operations of FIG. 6.

Accordingly, a spiral flow of a magnetic field is shown with a structure having a supporter and a rotor further mounted in interval of 60 degree from the structure of FIG. 3.

Stators with coils wound and a rotors 63 are shown in FIG. 6, and, in FIG. 7, magnet pole pieces(faces) of stators 71-1 and 71-2 as an integral stator 71 has a skew angle to induce a spiral flux of a magnetic field, so that a rotating force of a rotor 73 is smoothly generated.

That is, a magnetic flux of a rotating magnet 63 passes through a slit to be induced on a magnet pole piece 61A of a static armature, and the induced magnetic flux 65 moves along another static armature 68 up to another rotating magnet 67. With this operation repeated, a rotating force by a spiral flux of a magnetic field is generated.

The apparatus according to the present invention has the following effects through some embodiments.

That is, as applied to a generator, since an electromotive force wave is a rectangular wave, a DC conversion characteristic is excellent, material loss is small since only necessary material is machined with less redundancy of a magnetic circuit. The minimization of the material loss brings the minimization of iron core loss and magnetic resistance to reduce energy loss.

Further, since the action and reaction is simultaneously applied when loaded, the minimization of a mechanical energy is achieved and a conversion loss from AC to DC can be minimized.

In the meantime, as applied to an electric motor, since the rotation

movement is that attraction force and repulsion force is applied in parallel with respect to the shaft, it is easy to absorb a vibration wave by a mechanical vibration so that a high speed rotation can be obtain, and since a skew space arrangement and a twist angle are easily obtained, calking torque can be reduced greatly.

## CLAIMS

What is claimed is:

1. A magnetic circuit for a rotating apparatus having a parallel structure or a skew structure of magnet pole pieces of magnets or armatures with respect to a shaft, comprising:

a rotating shaft;

a plurality of supporters fixedly mounted in a perpendicular direction to the circumference of the rotating shaft;

a plurality of rotors rotated by attraction force and repulsion force of a magnetic field, a magnet pole piece being arranged in parallel with respect to the shaft on each end of the plurality of supporters; and

a plurality of armatures (stators) having a coil wound on the body thereof, the coil being mounted at an interval ouside the rotors and receiving induced alternate magnetic flux of the rotors, the alternate magnetic flux generated when rotated, and magnet pole pieces being arranged in parallel or in skew with the rotating shaft.

2. The magnetic circuit for a rotating apparatus as claimed in claim 1, wherein the rotors have the parallel structure or the skew structure of the magnet pole pieces of the magnets with respect to the shaft so as to be rotated by a force of a magnetic field in a parallel direction with the rotating shaft.

3. The magnetic circuit for a rotating apparatus as claimed in claim 1, wherein the armatures have the parallel structure or the skew structure of magnet

pole pieces of magnets or armatures with respect to the shaft, and the magnets or armatures are one of C-type, U-type, and I-type.

4. The magnetic circuit for a rotating apparatus as claimed in claim 1, wherein the magnet pole pieces of the magnets or the armatures have a parallel structure or a skew structure with respect to the shaft, and the magnets or the armatures have propellers on a supporter between the shaft and the rotors.

5. The magnetic circuit for a rotating apparatus which comprises, the magnet pole pieces of the magnet or the armatures having the parallel structure or the skew structure with respect to the shaft and the rotors being rotated by a force of a magnetic field formed in the parallel direction with the rotating shaft and thus minimizing the lateral vibration of the shaft under rotation.

6. A magnetic circuit for a rotating apparatus having a parallel structure or a skew structure, the rotating apparatus being a rectangular wave generator or a rectangular wave electric motor, comprising:

rectangular wave electric power generating means for generating a rectangular wave electromotive force and a rectangular wave signal with a discontinuous flow of a magnetic flux by eliminating a york which is a magnetic circulation medium between armatures and magnets;

spiral magnetic flux deriving means constituting a magnetic circuit which generates a spiral flow of a magnetic flux on rotation with the bodies of armatures or magnets having a twist angle of a skew structure;

mechanical dynamic force generating means having a rotation unit constituted with a plurality of armatures and a plurality of magnets in order for a rotor to be rotated by a rectangular wave alternate magnetic flux generated with input of electrical energy, and enabling parallel driving according to a required quantity of torque by constituting a plurality of the rotation units in row with respect to the shaft;

phase detecting means and position detecting means for obtaining a phase angle and position information according to a quantity change of a rectangular wave electromotive force generated by an armature of a different winding at a required position; and

direct current electric power generating means for generating a direct current electric power by collectively connecting rectangular wave electric powers of a plurality of armatures in a single phase manner.

FIG. 1A

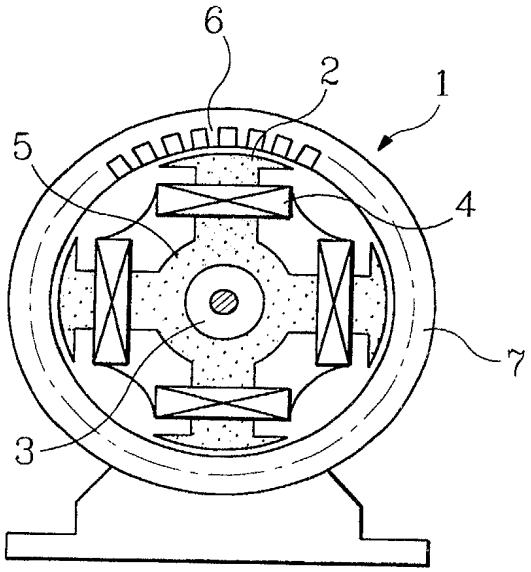



FIG. 1B

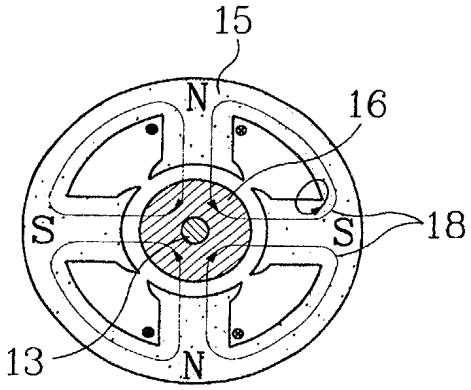


FIG. 2A

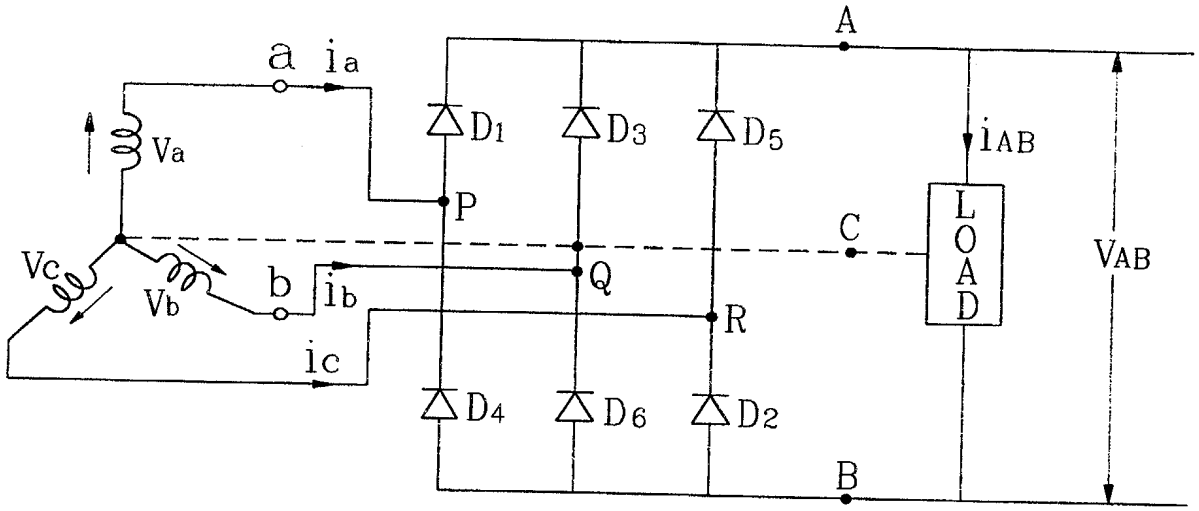


FIG. 2B

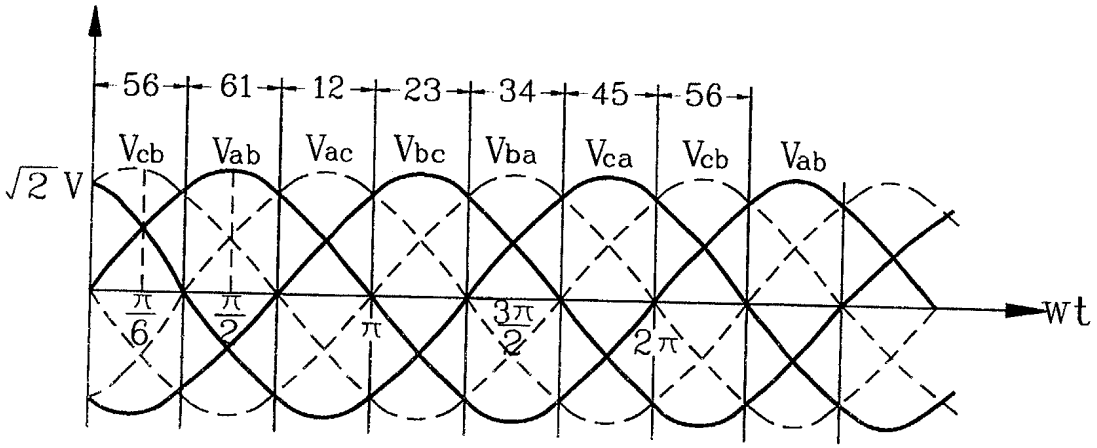

56
61
12
23
34
45
56
Vcb
Vab
Vac
Vbc
Vba
Vca
Vcb
Vab
√2 V
π/6
π/2
π
3π/2
2π
wt

FIG. 2C

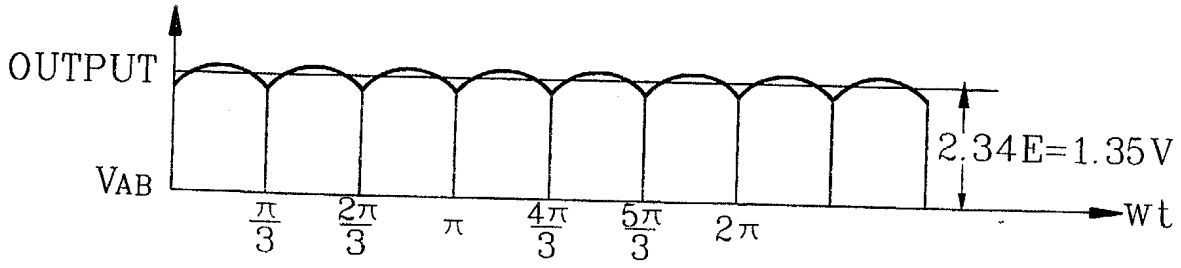

OUTPUT
VAB
2.34E=1.35V
π/3
2π/3
π
4π/3
5π/3
2π
wt

FIG. 3

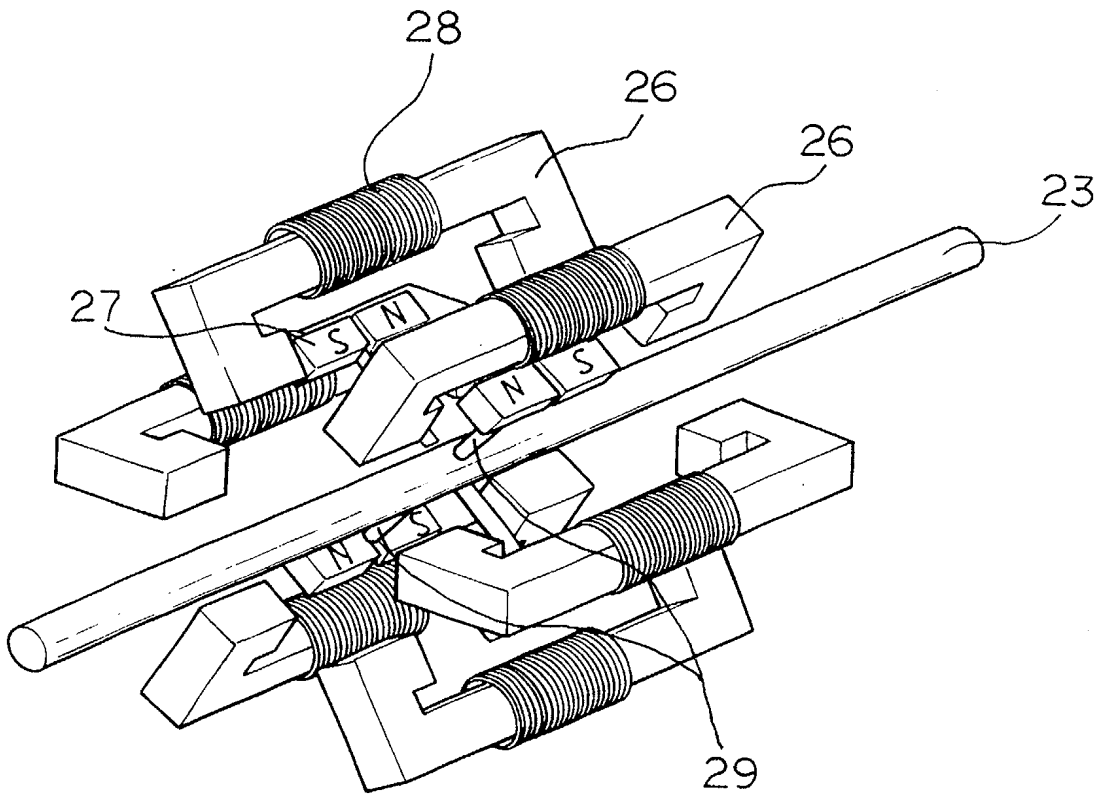


FIG. 4A

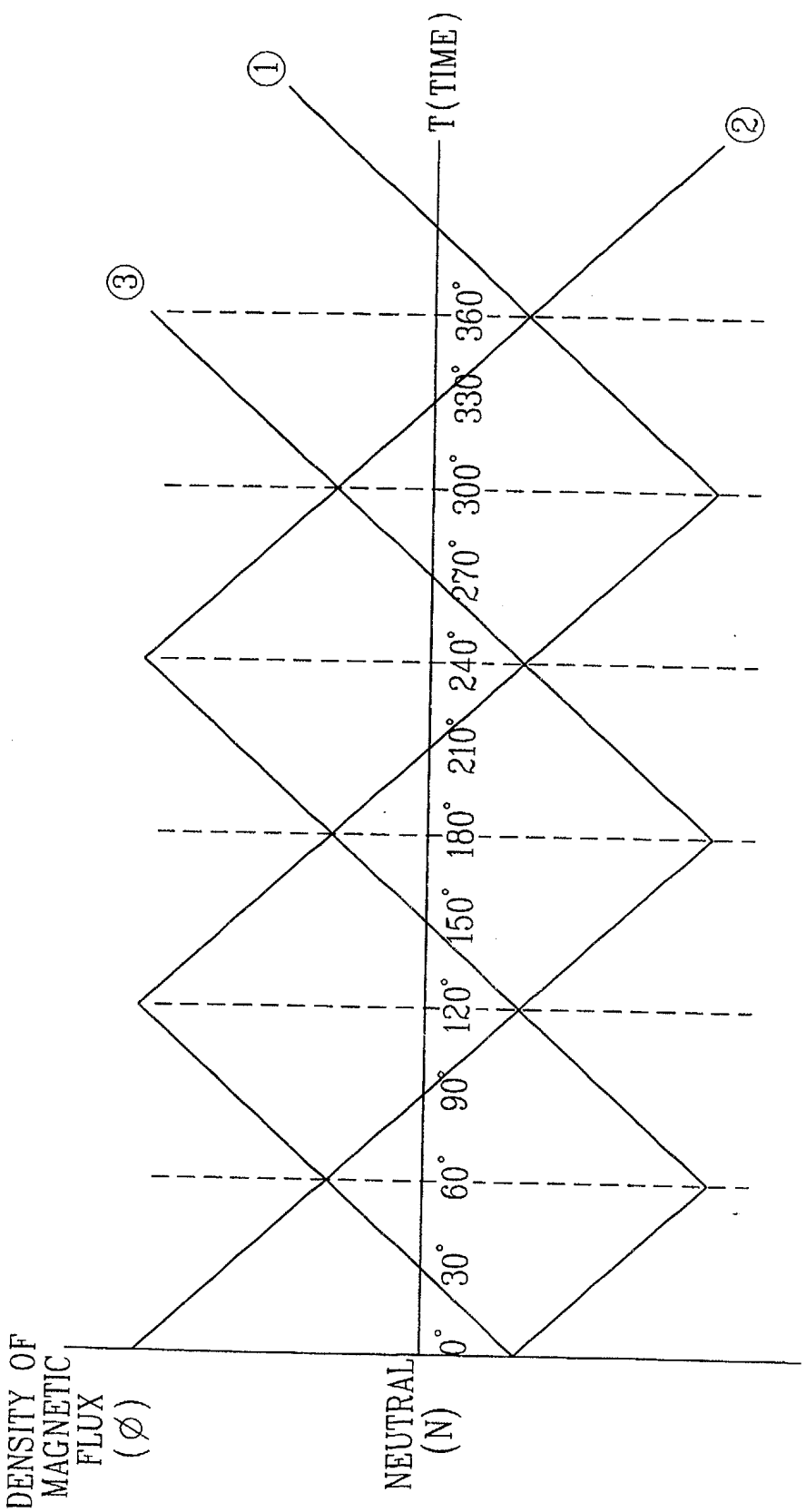

①
②
③
T(TIME)
0°
30°
60°
90°
120°
150°
180°
210°
240°
270°
300°
330°
360°
NEUTRAL (N)
DENSITY OF MAGNETIC FLUX (∅)

FIG. 4B

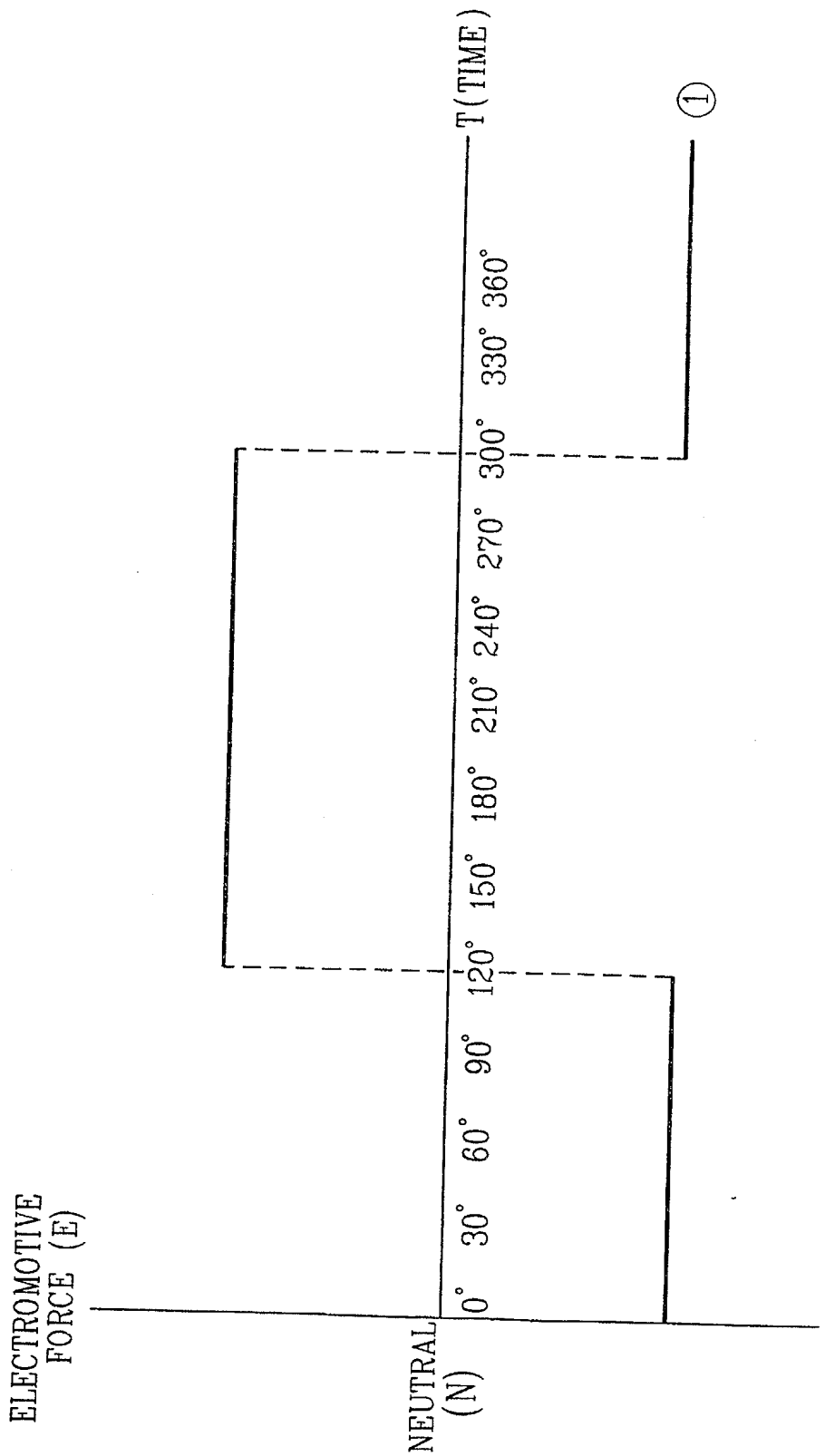
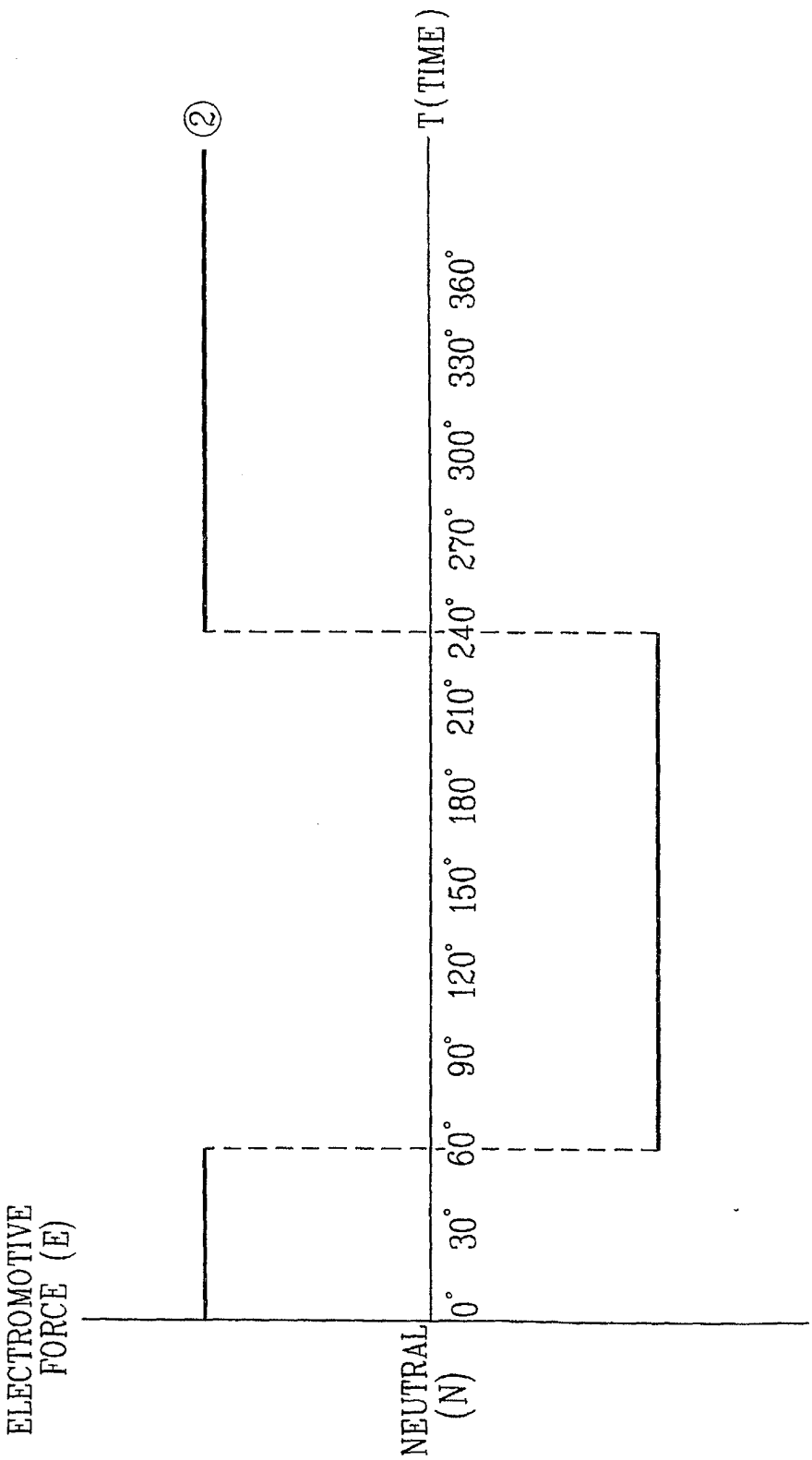

ELECTROMOTIVE FORCE (E)
NEUTRAL (N)
0°
30°
60°
90°
120°
150°
180°
210°
240°
270°
300°
330°
360°
T(TIME)
①

FIG. 4C


ELECTROMOTIVE FORCE (E)
NEUTRAL (N)
T(TIME)
0°
30°
60°
90°
120°
150°
180°
210°
240°
270°
300°
330°
360°
②

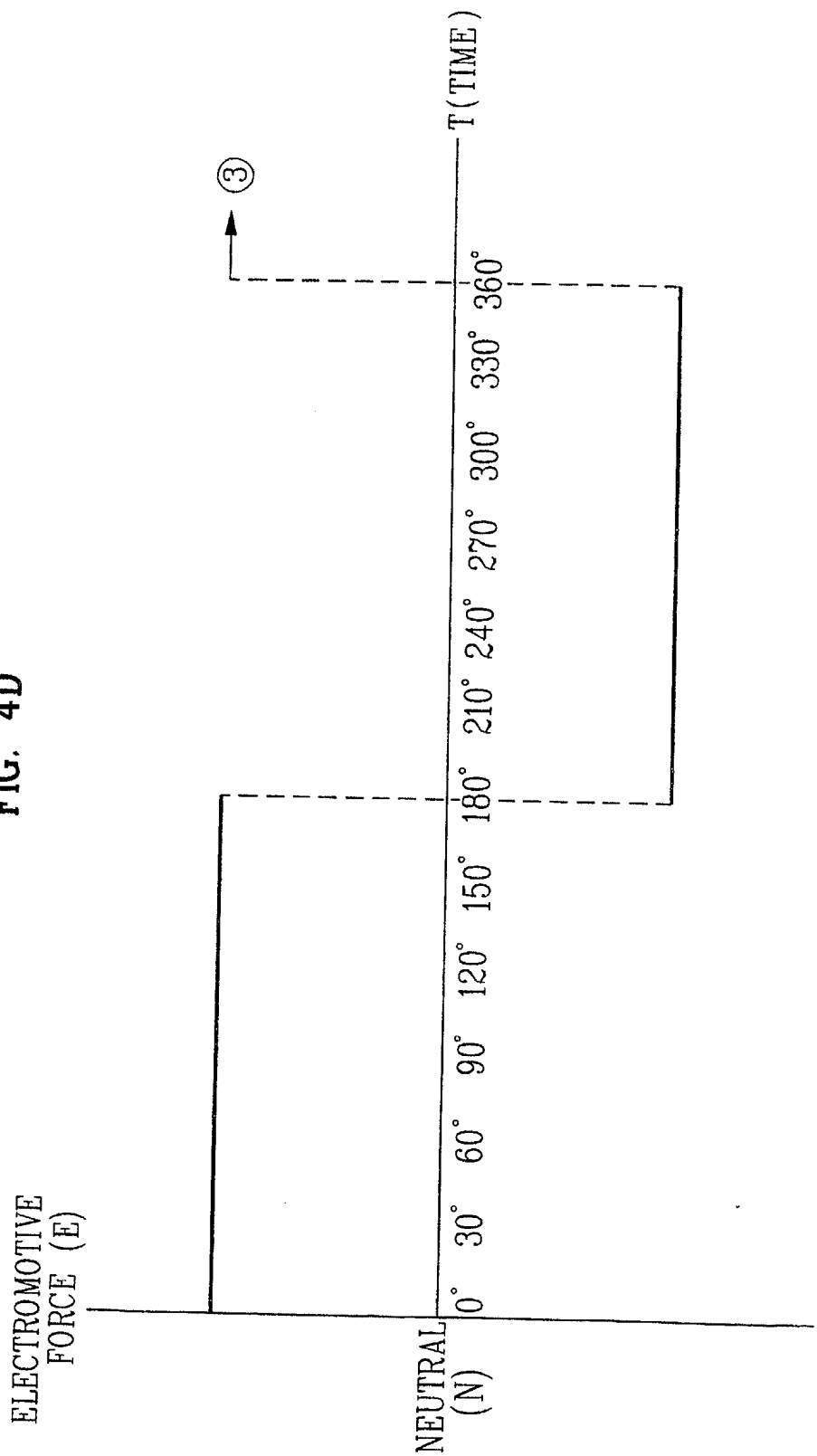

T(TIME)
③
0° 30° 60° 90° 120° 150° 180° 210° 240° 270° 300° 330° 360°
ELECTROMOTIVE FORCE (E)
NEUTRAL (N)

FIG. 4D

FIG. 4E

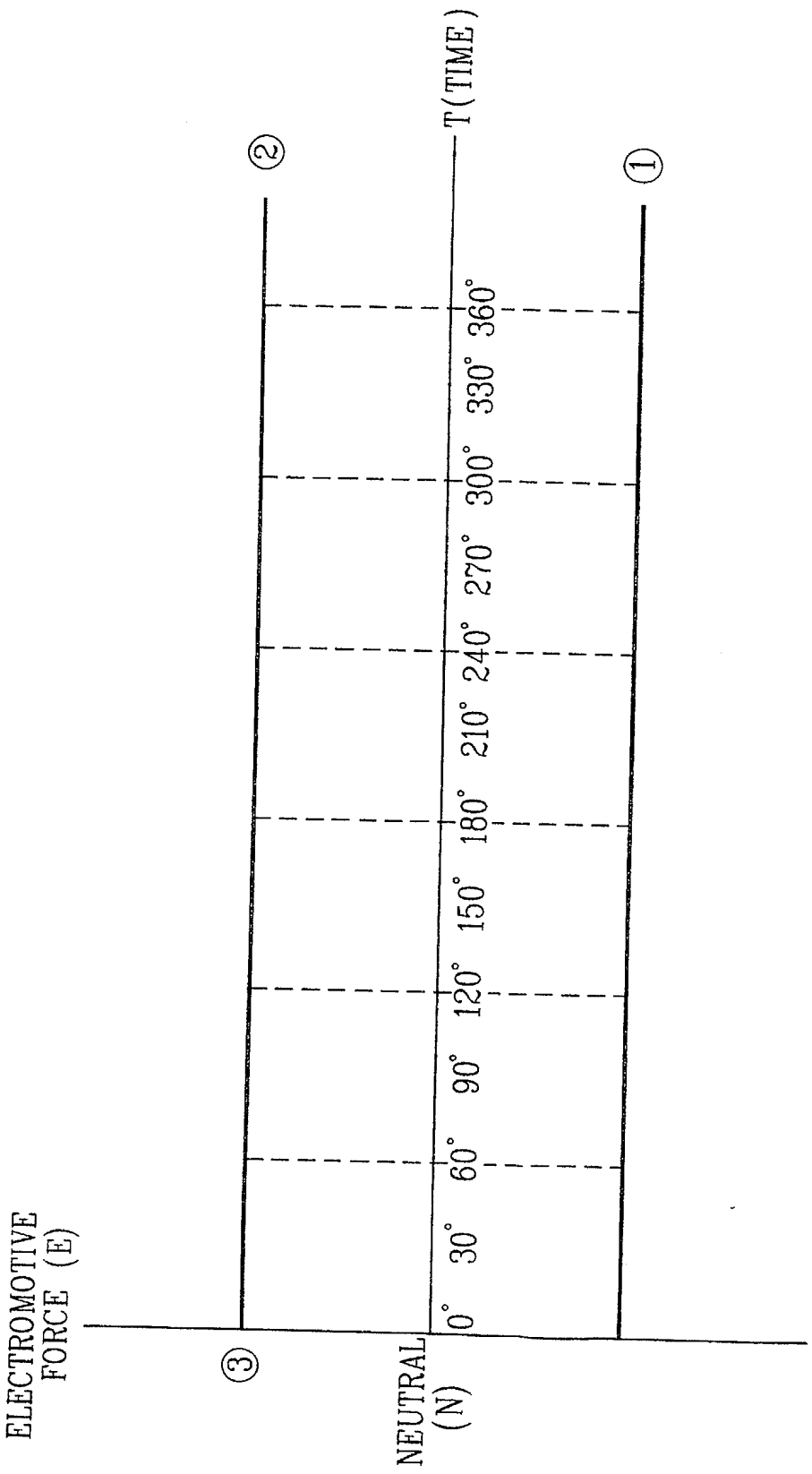

T(TIME)
②
①
③
0°
30°
60°
90°
120°
150°
180°
210°
240°
270°
300°
330°
360°
ELECTROMOTIVE FORCE (E)
NEUTRAL (N)

FIG. 5A

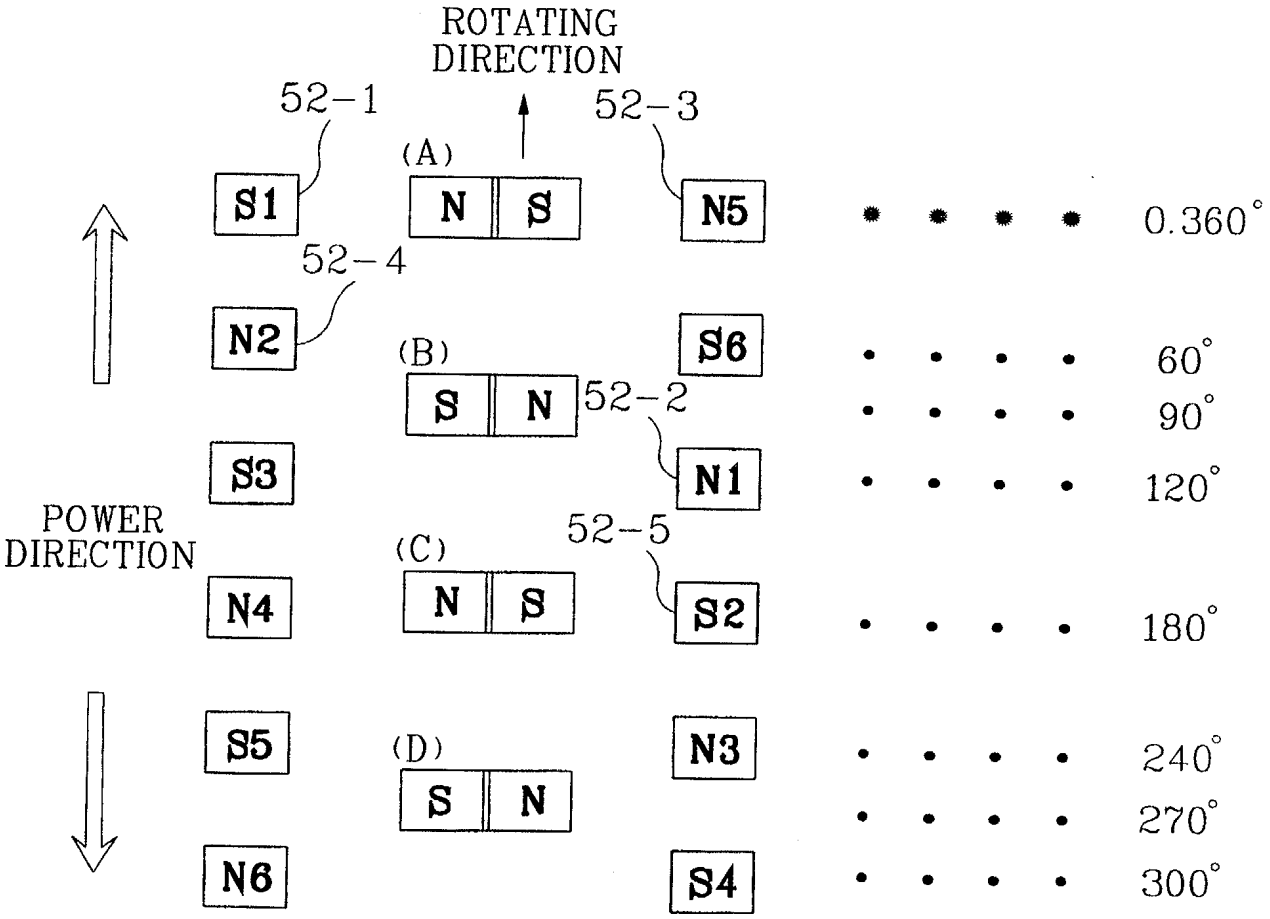

ROTATING DIRECTION
52-1
52-3
(A)
S1
N
S
N5
0.360°
52-4
N2
(B)
S6
60°
S
N
52-2
90°
S3
N1
120°
POWER DIRECTION
52-5
(C)
N4
N
S
S2
180°
S5
(D)
N3
240°
S
N
270°
N6
S4
300°

FIG. 5B

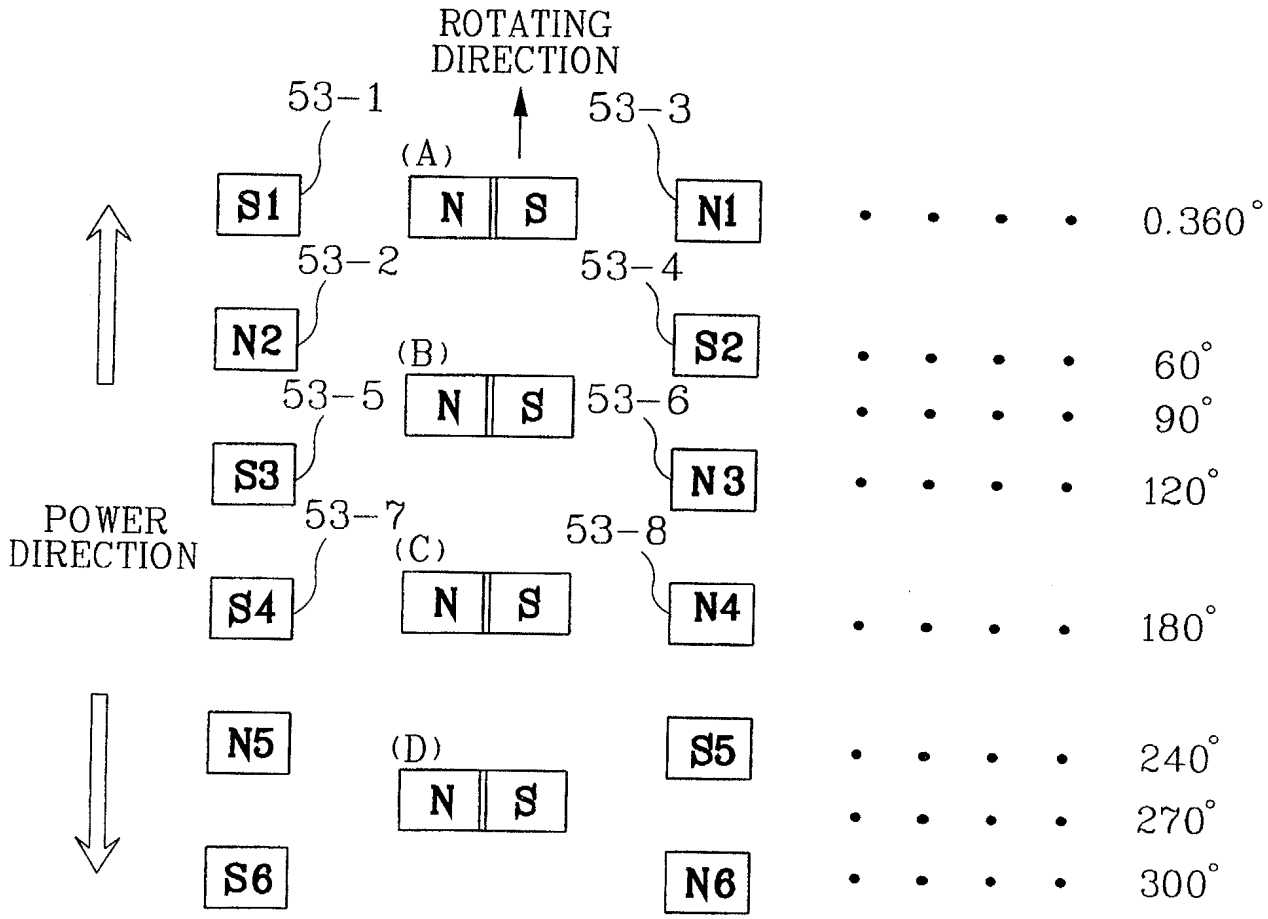

ROTATING DIRECTION
53-1
53-3
(A)
S1
N
S
N1
0.360°
53-2
53-4
N2
S2
(B)
60°
53-5
N
S
53-6
90°
S3
N3
120°
POWER DIRECTION
53-7
53-8
(C)
S4
N
S
N4
180°
N5
S5
(D)
240°
N
S
270°
S6
N6
300°

FIG. 6

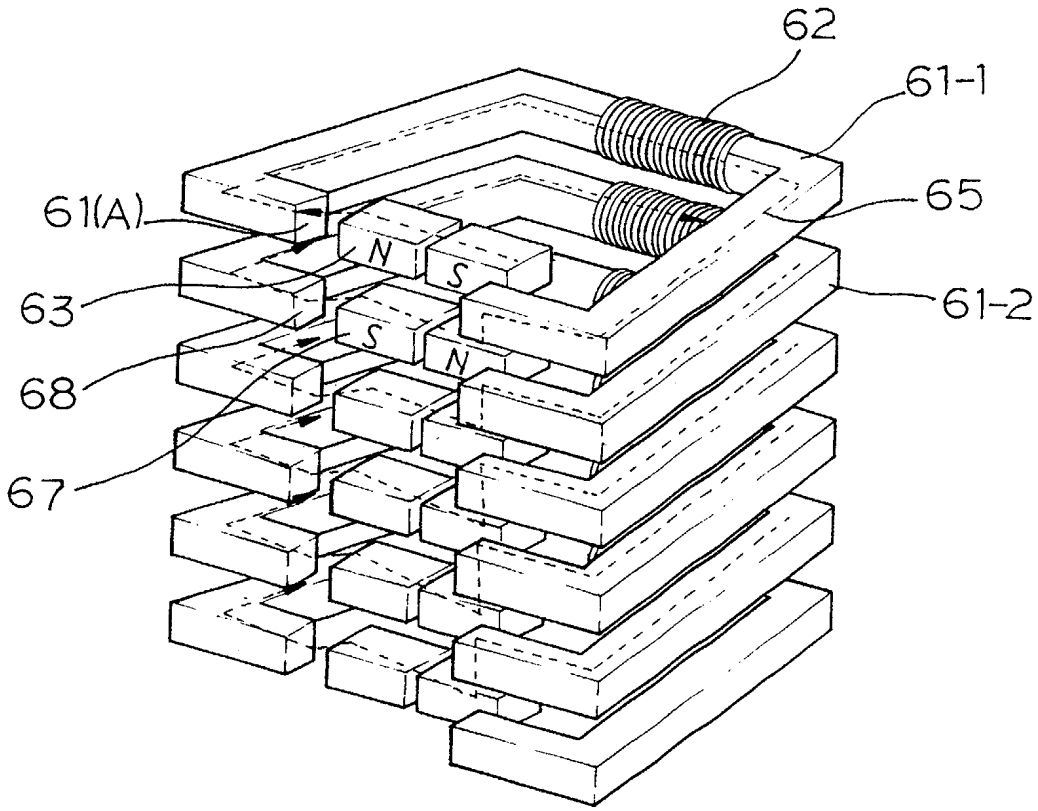
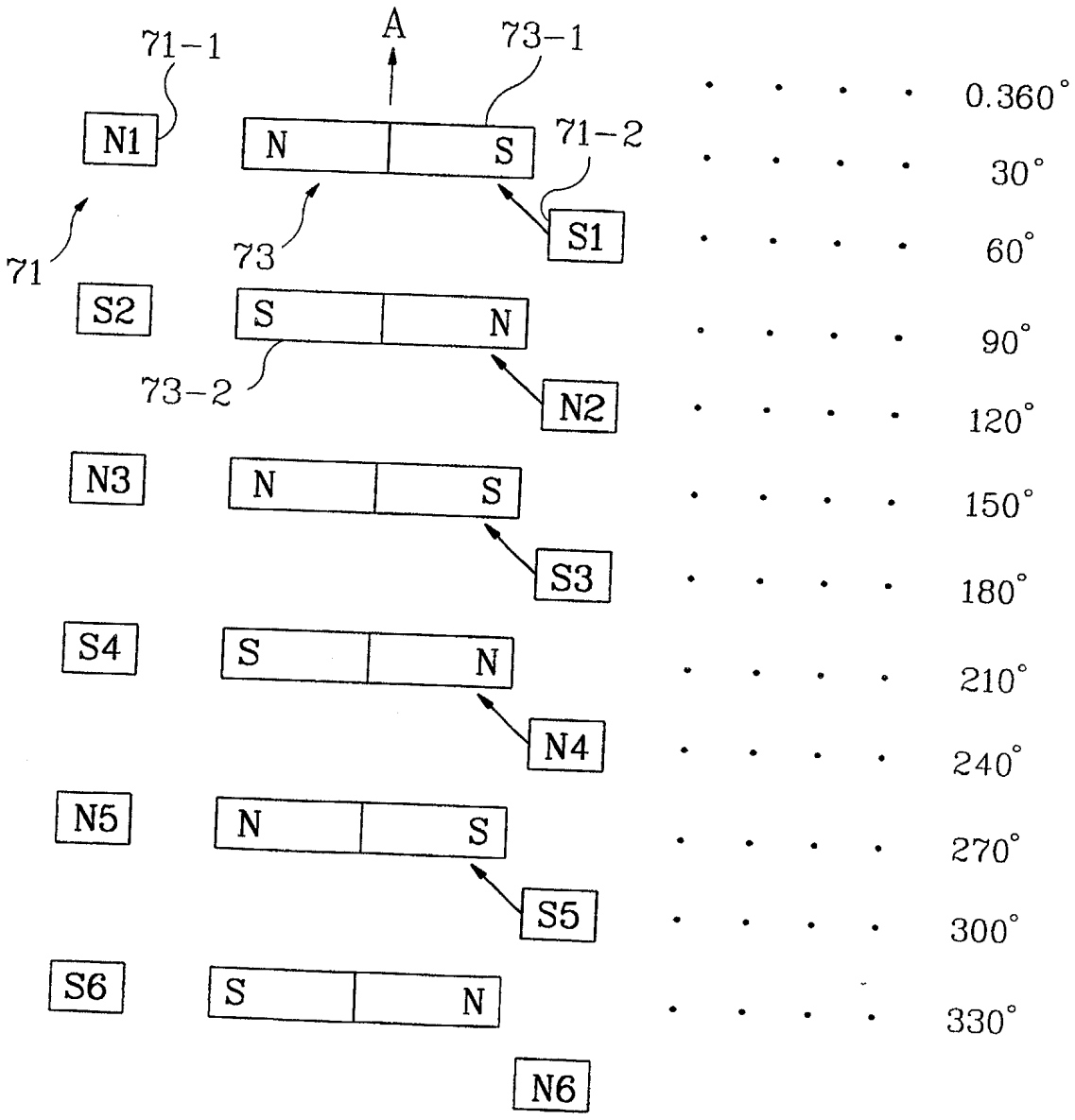


FIG. 7


A
71-1
73-1
71-2
N1
N
S
S1
71
73
S2
S
N
73-2
N2
N3
N
S
S3
S4
S
N
N4
N5
N
S
S5
S6
S
N
N6
0.360°
30°
60°
90°
120°
150°
180°
210°
240°
270°
300°
330°